

WHAT IS CLAIMED IS:

1 1. A servomechanism having proportional, integral, and
2 differential control (PID) receiving an error signal and
3 generating a command signal comprising:
4 a first gain block having an input receiving the error
5 signal, an output and a first gain;
6 a first rate-limiter block having an input connected to
7 said output of said first gain block, an output and a first
8 rate limit;
9 a derivative block having an input receiving the error
10 signal and an output;
11 a first summer-block having a first input connected to
12 said output of said first rate-limiter block and a second
13 input connected to said output of said derivative block and a
14 first sum output;
15 a second rate-limiter block having an input connected to
16 said output of said first gain block, and output and a second
17 rate limit less than said first rate limit;
18 an integrator block having an input connected to said
19 first sum output of said first summer-block and an output;
20 a second gain block having an input connected to said
21 output of said integrator block, an output and a second gain;
22 a third gain block having an input connected to said
23 output of said derivative block, an output and a third gain;
24 and
25 second summer-block having a first input connected to
26 said output of said second gain block, a second input
27 connected to said output of said third gain block, a third
28 input connected to said output of said second rate-limiter

29 block, and a second sum output, said second sum output being
30 said command signal.

1 2. The servomechanism of claim 1 further including:
2 a fourth gain block having an input connected to said
3 second sum output of said second summer-block, an output being
4 said command signal and a fourth gain.

1 3. The servomechanism of claim 1 further including:
2 at least one low-pass filter connected between said
3 output of said derivative block and said input of said first
4 summer-block and said input of said third gain block.

1 4. The servomechanism of claim 3 wherein:
2 said at least one low-pass filter includes
3 a first low-pass filter having an input connected to
4 said output of said derivative block, an output and a
5 first cutoff frequency, and
6 a second low-pass filter block having an input
7 connected to said output of said first low-pass filter,
8 and output and a second cutoff frequency higher than said
9 first cutoff frequency.

1 5. The servomechanism of claim 4 wherein:
2 said first cutoff frequency and said second cutoff
3 frequency are both higher than an effective cutoff frequency
4 of said integrator block and an effective cutoff frequency of
5 said derivative block.

1 6. The servomechanism of claim 5 wherein:
2 said first gain K_R , said second gain K_I , said third gain
3 K_D and said fourth gain K_C are set whereby

4

$$K_i = 2 \times w_1$$

$$K_r = 2 \times w_1$$

5

$$K_d = \frac{(4 \times w_1)}{w_2}$$

$$K_c = \frac{1}{(4 \times w_1)}$$

6

7 where W_1 is said effective cutoff frequency of said integrator
8 block and W_2 is said effective cutoff frequency of said
9 derivative block.

1 7. A method of servo control receiving an error signal
2 and generating a command signal comprising the steps of:
3 amplifying the error signal by a first gain;
4 limiting the amplified error signal by a first rate
5 limit;
6 forming a derivative of the error signal;
7 summing the a first rate limited amplified error signal
8 and the derivative of the error signal thereby forming a first
9 sum signal;
10 limiting the amplified error signal by block second rate
11 limit, the second rate limit less than the first rate limit;
12 integrating block the first sum signal;

13 amplifying the derivative of the error signal by a second
14 gain;
15 amplifying the integrated first sum signal by a third
16 gain; and
17 summing amplified first sum signal, the amplified
18 derivative signal and the second rate limited error signal
19 thereby forming a second sum signal being said command signal.

1 8. The method of claim 7 further including:
2 amplifying the second sum signal by a fourth gain.

1 9. The method of claim 7 further including:
2 low-pass filtering the derivative signal.

1 10. The method of claim 9 wherein:
2 said step of low-pass filtering the derivative signal
3 includes
4 a first low-pass filtering having a first cutoff
5 frequency, and
6 a second low-pass filtering having a second cutoff
7 frequency higher than said first cutoff frequency.

1 11. The method of claim 10 wherein:
2 said first cutoff frequency and said second cutoff
3 frequency are both higher than an effective cutoff frequency
4 of said integrator block and an effective cutoff frequency of
5 said derivative block.

1 12. The method of claim 11 wherein:
2 said first gain K_R , said second gain K_I , said third gain
3 K_D and said fourth gain K_C are set whereby

4

$$K_i = 2 \times w_1$$

$$K_r = 2 \times w_1$$

5

$$K_d = \frac{(4 \times w_1)}{w_2}$$

$$K_c = \frac{1}{(4 \times w_1)}$$

6

7 where w_1 is said effective cutoff frequency of said integrator
8 block and w_2 is said effective cutoff frequency of said
9 derivative block.